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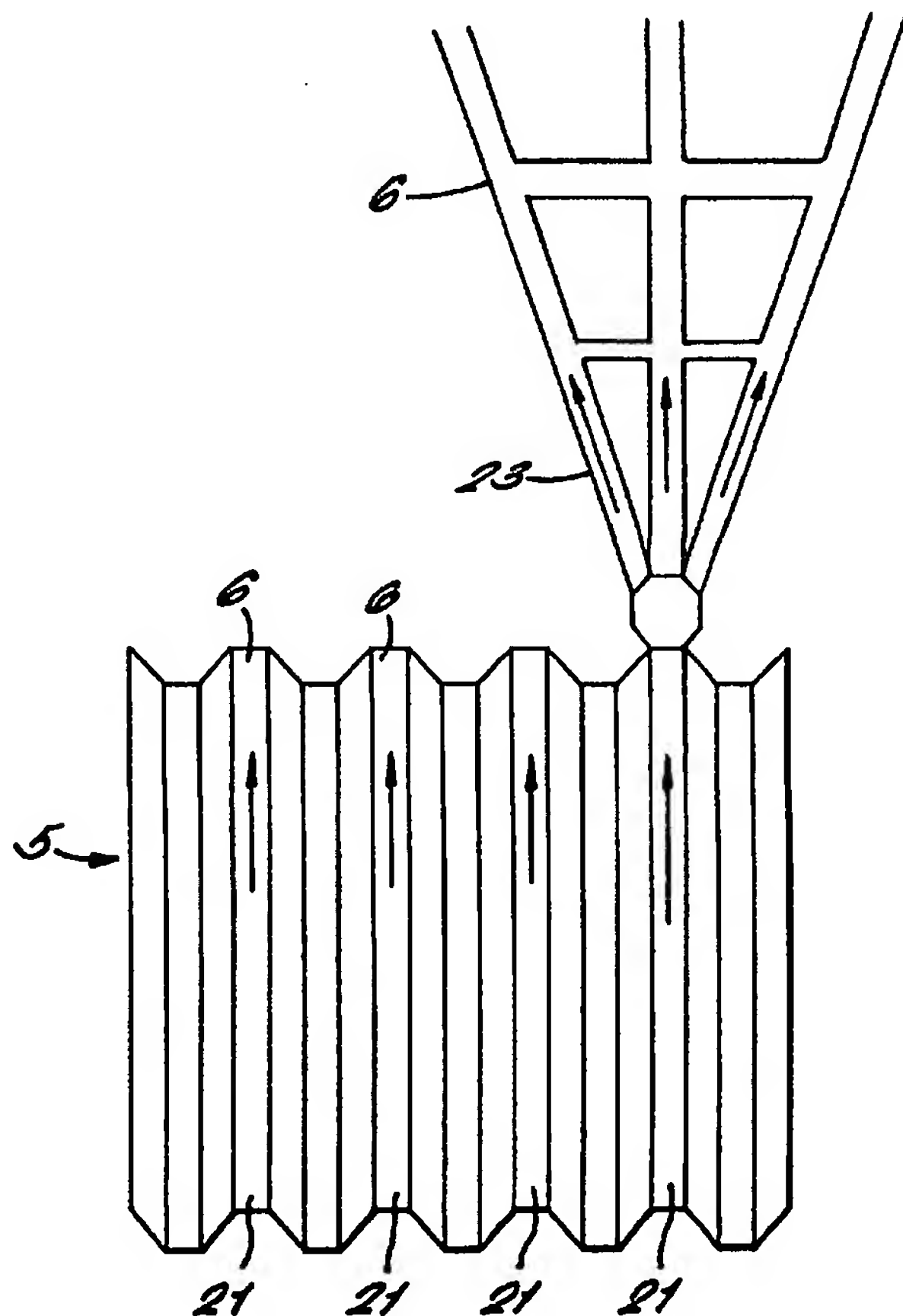
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[Continued on next page]

(54) Title: AN EMANATOR DEVICE



(57) Abstract: An emanator for emanating a composition  
into its surroundings, the emanator comprising: a container  
for containing a volatile liquid comprising a composition to  
be emanated; an emanation surface from which the volatile  
liquid evaporates; a wick for transporting the volatile liquid  
from the container to the emanation surface, characterised in  
that the transport of the liquid through both the wick and the  
emanator occurs at the surface of both the wick and the em-  
anator and in that transport of the liquid through the wick  
occurs only at the surface of the wick by capillary action.  
In a preferred embodiment the wick and the emanation sys-  
tem are integrally formed from a material formed with mi-  
crogrooves.

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### An Emanator Device

This invention relates to a wick and emanation surface, and particularly, but not exclusively, to a wick and emanation surface for use in an insecticidal device or an air freshener.

A particular type of insecticidal device or air freshener is known as an emanator. An emanator comprises a container in which a reservoir of volatile liquid is contained. The volatile liquid contains within it additives in the form of insecticidal compositions, if the device is an insecticidal device, or fragrance compositions, if the device is an air freshener. The device further comprises an emanation surface, from which the volatile liquid evaporates into its surroundings, and a wick extending from the reservoir to the emanation surface, for transporting the liquid from the reservoir to the emanation surface for evaporation. Evaporation of the liquid results in the fragrance or insecticidal compositions being released into the surroundings.

For the sake of clarity the term air freshener will be used herein to refer to insecticidal devices as well as air fresheners, and the term fragrance composition will be used herein to refer to insecticidal compositions as well as fragrance compositions.

Known wicks for use in emanators typically comprise a bundle of fibres loosely twisted, or a braided or woven cord, tape or tube, which draws up by capillary action the liquid in the reservoir and transports it to the emanation surface where it evaporates.

Wicks may also be made from non-woven material, and porous polymer materials such as sintered plastics may also be used.

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A disadvantage of known emanators is that it is necessary to use a separate wick and emanation surface. This is because in order for a capillary action in a wick to effectively and efficiently draw up liquid from the reservoir to the emanating surface, it is necessary for a large void volume to exist within the capillary structure within the wick. Such a void structure does not, however, produce an efficient emanation surface.

15 A further disadvantage is that the structure of one or both of these components will vary from piece to piece due to manufacturing processes.

According to the first aspect of the present invention there is provided an emanator for emanating a composition into its surroundings, the emanator comprising:

a container for containing a volatile liquid comprising a composition to be emanated;

25 an emanation surface from which the volatile liquid evaporates;

a wick for transporting the volatile liquid from the container to the emanation surface,

characterised in that the transport of the liquid through both the wick and the emanator occurs at the surface of both the wick and the emanator and in that transport of the liquid through the wick occurs only at the surface of the wick.

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According to a second aspect of the present invention, there is provided an emanator for emanating a composition into the surroundings, the emanator comprising:

- 5 a container for containing a volatile liquid comprising a composition to be emanated;
- an emanation surface from which the volatile liquid evaporates;
- a wick for transporting the volatile liquid from the
- 10 container to the emanation surface,

characterised in that the wick and the emanation surface are integrally formed, and in that the wick transports the liquid from the container to the emanation surface only by means of capillary action at the surface of

15 the wick.

The combined wick and emanation surface will be referred to herein as the wicking and emanation system.

- 20 By having the wick and the emanation surface integrally formed, the device is simpler and therefore cheaper to manufacture and assemble, and will allow improved consistency across and within the batch production.

- 25 Advantageously, the wicking and emanation system is formed from a material formed with microgrooves. The term microgroove means a groove having a width measured in micrometers, or sub-micrometers. The grooves may have any suitable cross-sectional shape, such as semi-circular or
- 30 rectangular, triangular or frusto-triangular in cross-section. A material formed with microgrooves may be described as being micro-structured or having a micro-structure.

The microgrooves act as capillaries, and are subdivided or geometrically varied at the emanation surface to provide an extensive area for evaporation.

5

The wicking and emanation system may be made from any material that is capable of being formed into microgrooves, but preferably the system is formed from a thermoplastics based material.

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A method of forming a microstructure is described in International patent application no. PCT/US99/01566 filed by Minnesota Mining and Manufacturing Company.

15

It is known from this patent application, that materials such as acrylates or urathane are suitable for forming an illuminating device, i.e. a light guide having one or more output portions arranged in such a fashion as to provide a desired pattern of illumination at a desired intensity. The materials are used to form a microstructure which in turn forms the illuminating device.

20

The present inventors have made the surprising discovery that a microstructure may be used as a wicking and emanation device in emanators of the type described herein. The materials described and discussed in WO 99/42270 would not be suitable for use as a combined wick/emanator. This is because materials such as acrylates and urathane would react with fragrances in the volatile liquid to be emanated and stress-cracking would occur.

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It is known in the field that fragrances or insecticidal actives tend to be particularly aggressive towards certain types of polymers. The fragrances or

insecticidal actives are capable of reacting with these types of polymers and breaking down the molecular structures of the polymers causing stress cracking to occur.

5        Suitable materials would therefore be ones which resist attack from the fragrances or insecticidal actives such as polyolefins and PETG which stands for polyethyltetraphalateglycol.

10        A whole range of materials are likely to be suitable for forming the microstructure. For the present invention it is important to be able to choose a material which is chemically resistant to the fragrances to be used and has a relatively low cost.

15        Preferably, the wick portion of the system comprises material having a microstructure in the form of substantially parallel grooves, each having a width in the range of 50 microns - 750 microns and positioned adjacent  
20        one another.

      It has been found that microgrooves having a diameter of 50 microns to 750 microns, subject to surface tensions and product viscosity, produce a material having  
25        particularly good capillary action.

      Advantageously, the emanation portion of the system comprises a microstructure comprising microgrooves which fan out from the wicking microgrooves to form an emanation  
30        surface having a surface area to volume ratio that is large.

      For the emanation surface to perform effectively in the emanation of the liquid, it is necessary for there to be a



large surface area to volume ratio in the range 5:1 to 100:1. The larger the surface area the higher the emanation rate by the process of surface air flow. The shallower the channels the more efficient the fragrance volume to fragrance release. There is of course a limit to the optimum ratio of surface area to volume, in that in an extreme situation, where there was virtually no depth of liquid, surface tension would have an adverse effect on the emanation of the liquid.

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Ideally the rate of wicking and emanation should be matched for optimisation. The particular size and geometry of the grooves will depend upon the volatility of the fragrances used in the volatile liquid, however, for most applications, the release rate of the fragrance should be in the order of 0.1 cm<sup>3</sup> to 10 cm<sup>3</sup> per day. The size and geometry of the structure will therefore be calculated to result in a rate of release within this range. The emanator grooves are repositioned relative to the wicking grooves such that their depth is minimised and their surface area maximised within the constraints of fragrance transport.

20

An advantage of using a microstructure to form the wicking and emanation system is that the transport of liquid is a surface transport and therefore absorption of the liquid into the system is minimal, if not non existent, thus improving evaporation efficiencies from the surface and reducing fragrance capture as experienced with absorption pads.

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The invention will now be further described by way of example only with reference to the accompanying drawings in which:



Figure 1 is a schematic representation of a wicking and emanation system according to the present invention; and

5        Figure 2 is a schematic representation of the wicking and emanation system of figure 1 showing the microstructure of the system.

Referring to Figure 1 a wicking and emanation system  
10 according to the present invention is designated generally by the reference 1. The wicking and emanation system forms part of an emanator which may be used as an air freshener or insecticidal device. For the sake of clarity the present example will be described in terms of an air freshener.

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The device incorporating the wicking and emanation system will be referred to by reference numeral (2). The emanator(2) comprises a liquid reservoir (3) formed in a container (4). The wicking and emanation system (1),  
20 comprises a wicking portion (5) and an emanation system (6). The wicking portion (5) has an end (7) remote from the emanation surface, which end is in contact with the liquid (3). Liquid from the liquid reservoir (3) is drawn up the wick portion (5) of the wicking and emanation system (1) by  
25 means of capillary action.

When the liquid reaches the junction (8) between the wick portion (5) and the emanation surface (6) it is drawn into the emanation surface (6) also by capillary action to  
30 provide an extended surface area. Efficient evaporation can then occur from the emanation surface (6).

The liquid contained in the reservoir (3) comprises a volatile liquid in which chemical additives have been added. The additives are in the form of fragrances which are released into the atmosphere when the liquid evaporates at  
5 the emanation surface.

Referring now to figure (2), the microstructure of the wicking and emanation system (1) is shown. The wicking portion (5) comprises a plurality of grooves (6) positioned  
10 adjacent one another. The cross-section of the grooves is frusto-triangular, although any other suitable shape could be used. Liquid from the reservoir (3) is drawn up the grooves (21) by capillary action towards the emanation surface (6). At the emanation surface each groove (21)  
15 divides into a plurality of grooves (23), in this case three grooves. For the sake of clarity the grooves forming the emanation surface (6) have been shown extending from one groove (21) only. However, in reality similar structures would extend from each groove (21) providing an extended  
20 surface area from which the fragrance can evaporate.

## CLAIMS:

1. An emanator for emanating a composition into its surroundings, the emanator comprising:

5 a container for containing a volatile liquid comprising a composition to be emanated;

an emanation surface from which the volatile liquid evaporates;

10 a wick for transporting the volatile liquid from the container to the emanation surface,

characterised in that the transport of the liquid through both the wick and the emanator occurs at the surface of both the wick and the emanator and in that transport of the liquid through the wick occurs only at the surface of  
15 the wick.

2. An emanator for emanating a composition into the surroundings, the emanator comprising:

20 a container for containing a volatile liquid comprising a composition to be emanated;

an emanation surface from which the volatile liquid evaporates;

25 a wick for transporting the volatile liquid from the container to the emanation surface,  
characterised in that the wick and the emanation surface are integrally formed, and in that the wick transports the liquid from the container to the emanation surface only by means of capillary action at the surface of the wick.

30 3. An emanator according to claim 1 or claim 2 wherein the wicking and emanation system is formed from a material formed with microgrooves.

4. An emanator according to claim 3 wherein the microgrooves are subdivided or geometrically varied at the emanation surface to provide an extensive surface for evaporation.

5. An emanator according to any one of the preceeding claims wherein the wicking and emanation system is formed from a polyolefin.

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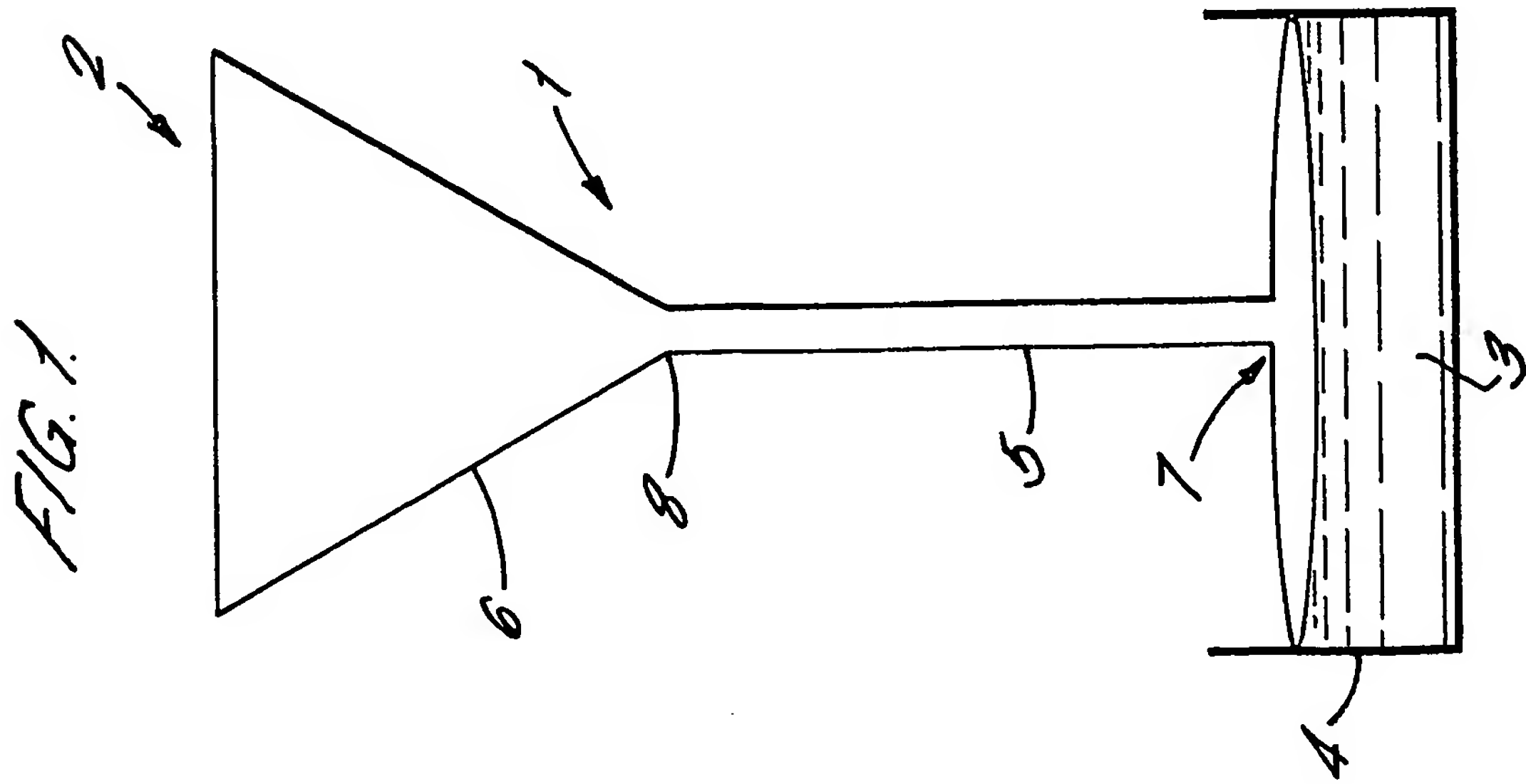
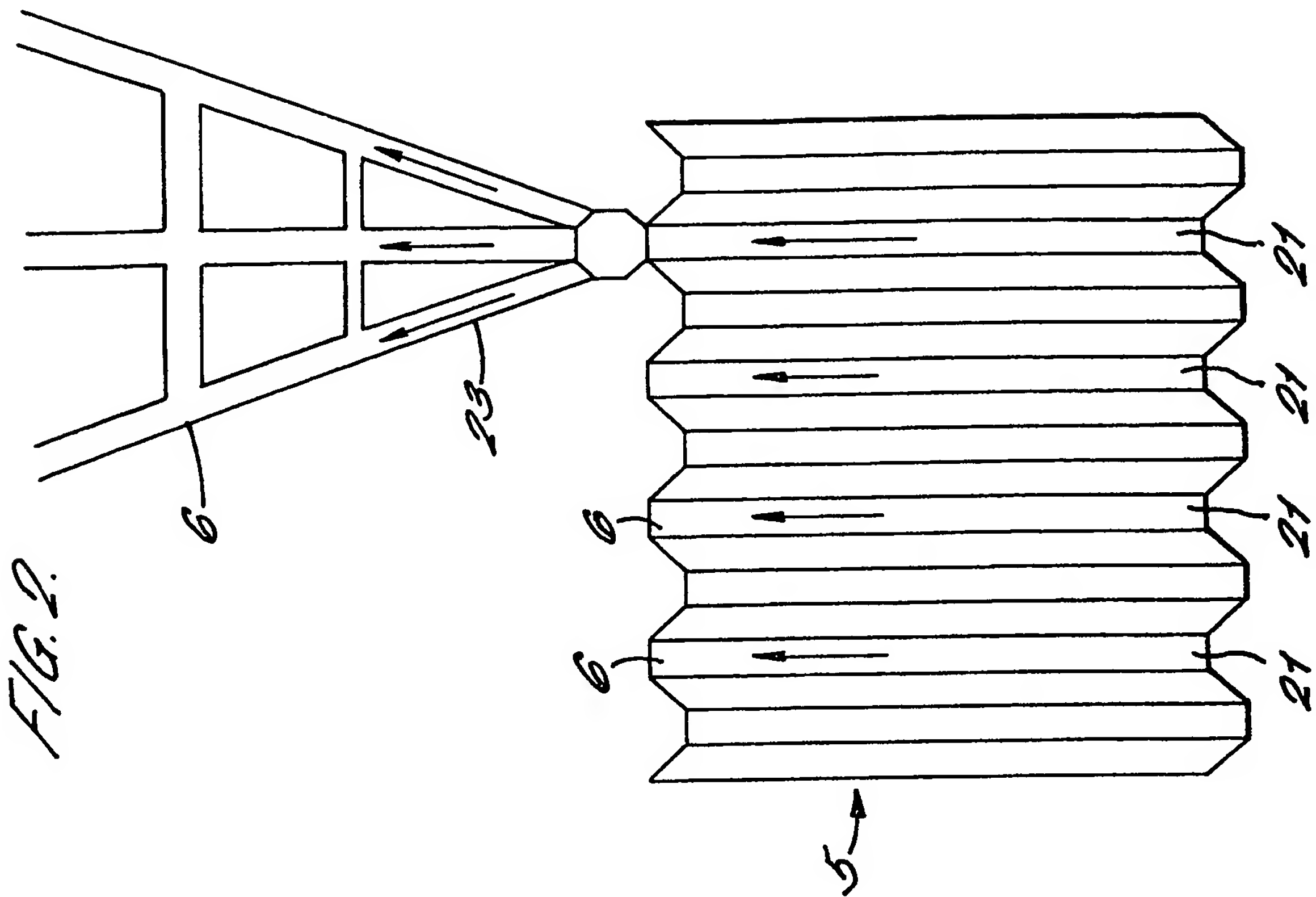
6. An emanator according to any one of the preceeding claims wherein the wick portion of the system comprises material having a microstructure in the form of substantially parallel grooves, each having a width in the range of 50 microns to 750 microns and positioned adjacent one another.

7. An emanator according to any one of the preceeding claims wherein the emanation portion of the system comprises a microstructure comprising microgrooves which fan out from the wicking microgrooves to form an emanation surface having a surface area to volume area that is large.

8. An emanator according to any one of the preceeding claims wherein the rate of wicking and emanation results in a release rate of  $0.1 \text{ cm}^3$  to  $10 \text{ cm}^3$  per day of the fragrance.

9. An emanator essentially as herein before described with reference to the accompanying drawings.

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A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 A61L9/12 A01M1/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	EP 1 033 139 A (VOIT HANS) 6 September 2000 (2000-09-06) figure 2 claim 1 ---	1, 3, 9
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Name and mailing address of the ISA

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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